

TWO NEW SPECIES OF *ELEUTHERODACTYLUS* (AMPHIBIA:
LEPTODACTYLIDAE) FROM NORTHEASTERN
SOUTH AMERICA

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Few *Eleutherodactylus* are known within the region bounded by the Rio Orino to the north and west and the Rios Amazonas and Negro to the south. Following Lynch's (1976) species group definitions, five members of the *unistrigatus* group [*E. grandoculis* (Van Lidth de Jeude), *E. inguinalis* Parker, *E. lacrimosus* (Jimenez de la Espada), *E. marmoratus* (Boulenger), and *E. pulvinatus* Rivero], one of the *auriculatus* group [*E. urichi* (Boettger)], and three of the *fitzingeri* group [*E. gollmeri* (Peters), *E. gutturalis* Hoogmoed, Lynch, and Lescure, and *E. vilarsi* (Melin)] are currently known or reported from northeastern South America. Van Lidth de Jeude's (1904) report of *E. gollmeri* is based on material of one of the new species named below and that record was not addressed by Rivero (1961) in his attempt to unravel the South American records of *E. gollmeri*. Hoogmoed, Lynch, and Lescure (1977) and Lynch (1975) have discussed separation of the cis-andean members of the *fitzingeri* group described to date.

In the course of fieldwork in Surinam, Hoogmoed secured series of and considerable ecologic data for the two species named below (his fieldwork was supported by the Netherlands Foundation for Advancement of Tropical Research (WOTRO), grants W 956-2 and W 87-78). Lynch had encountered both in museum collections and prepared preliminary descriptions for each. In the following accounts, specimens are identified by museum acronyms and numbers (if more than one specimen is included under a single number, the number of specimens is given parenthetically); the collections are as follows: American Museum of Natural History (AMNH); British Museum (Natural History), London (BM); Field Museum of Natural History, Chicago (FMNH); Museum of Natural History, The University of Kansas, Lawrence (KU); Los Angeles County Museum of Natural History (LACM); collection of Jean Lescure, Paris (LG, LGD); Museum of Comparative Zoology, Harvard University (MCZ); Rijksmuseum van Natuurlijke Historie, Leiden (RMNH); National Museum of Natural History, Washington (USNM); collection of Werner C. A. Bokermann, São Paulo (WCAB); and Zoologisch Museum (Instituut voor Taxonomische Zoologie), Amsterdam (ZMA).

Certain abbreviations are used in the text: E-N, distance between eye and nostril; IOD, interorbital distance; and SVL, snout-vent length. Measurements were taken with dial calipers to the nearest 0.1 mm. For

the measurements of holotypes both right and left side measurements are given if the feature is bilateral. Unless otherwise noted, all measurements refer to adult frogs; maturity in males was accepted if vocal slits were present, in females if large ova were present or if the oviducts were enlarged and convoluted. Drawings were made by Mr. W. C. G. Gertenaar and photographs by Mr. Chr. Hoorn, Jr., both of the Rijksmuseum van Natuurlijke Historie, Leiden. Each locality is numbered (see Figs. 4, 7) and these numbers appear in parentheses in the sections listing the paratype collections.

Eleutherodactylus chiastonotus, new species

Holotype.—RMNH 17614, an adult male, collected at Brownsberg, Brokopondo District, Surinam, 500 m, on 11 November 1968 by M. S. Hoogmoed (locality 5, fig. 4).

Paratypes.—(78). BRASIL, *Estado Amapá*: (27) Mazagão, WCAB 19177, 35968; (26) Serra do Navio, KU 140879-80, WCAB 2312-13, 3088-89, 18166-67, 35881-82.

FRENCH GUIANA: no further data, LG 1420; (21) Crique Gabrielle, LG 183; (24) Crique Grègoire, LG 15-16; (20) Eaux Clément (Montagne de Roura), LG 1230; (23) lower Matarony river, upstream from l'Approuague, LACM 44647, 44652; (18) Monts Attachi Bacca, LG 544-45; (17) opposite Nassau mountains, RMNH 17620; (16) 10 km NE St. Laurent, RMNH 17641(2); (19) Saül, base of Mt. Galbao, LG 1408-13; (22) Saut Tortue, ORSTOM camp, LACM 44655, 44657; (25) Trois Sauts, Oyapock river, LG 1280-81, 1369.

SURINAM, *Brokopondo District*: (5) Brownsberg, 500 m, RMNH 17613, 17615, 17616(2); Brownsberg, near Mazaronitop, 450 m, AMNH 87738-39; Brownsberg Natuurpark, MCZ 89194-97, 89211, 89214-18; (4) railway km 121, at foot of Brownsberg, RMNH 17621-22. *Marowijne District*: (7) Lely mountains, vicinity of Suralco camp IV, 600-690 m, RMNH 17637(3), 17639-40, 17745-46; (6) Lely mountains, 1 km S Suralco camp, V, 11 km NE airstrip, 620 m, KU 159620, RMNH 17636(2); (12) Loe Creek, 2nd camp, 120 m, RMNH 17633; (13) Loe Creek, Camp Hofwijks IV, 120 m, RMNH 17638; (15) Loe Creek, Camp Hofwijks VII, 54 km S Oelemari airstrip, 120-140 m, AMNH 90817, RMNH 17629-30, 17632, 17634, 17750; (14) Loe Creek, camp Hofwijks VIII, 56 km SSE Oelemari airstrip, 120 m, RMNH 17631; (15) 5 km SE camp Hofwijks VII, 59 km S Oelemari airstrip, 120 m, RMNH 17635; (10) Paloemeu airstrip, RMNH 15145; (2) Patamacca, 15 km S main emplacement, RMNH 17749. *Nickerie District*: (9) Gonini encampment, Coeroeni river, RMNH 17618(2); (8) King Frederick Willem IV Falls, BM 1936.9.3.15: (11) 4-5 km E Sipaliwini airstrip, RMNH 17617, 17619. *Para District*: (3) Afobaka road, 85 km

SSE Paramaribo, AMNH 87737. *Suriname District*: (1) 6 km S Blakawatra (forest service), RMNH 17642.

Diagnosis.—A moderate-sized *Eleutherodactylus* [$\delta \delta$ 26.7–39.7 mm SVL (\bar{x} = 33.0, n = 20), ♀ 37.5–53.4 (\bar{x} = 44.0, n = 14)] of the *fitzingeri* group; toes lacking webbing and lateral fringing; digits bearing pads and discs; pads of inner fingers 1.2–2.0 (\bar{x} = 1.5) times digit width below pad, those of outer fingers 2.0–3.2 (\bar{x} = 2.6); palmar tubercle bifid; no tarsal fold; no tubercles on heel; inner metatarsal tubercle much larger than outer; skin of dorsum finely shagreened, lacking warts; dorsolateral fold represented by row of pustules (none enlarged); tympanum prominent, its length about half eye length; choanae partially concealed by palatal shelf of maxillary arch; snout acuminate; males with vocal sac and slits; legs of moderate length, shank 51.4–64.6 percent SVL; venter cream with markings on throat; dorsum bearing prominent X-shaped mark; posterior surfaces of thigh pale tan, not patterned; limb bars as wide as interspaces, bars perpendicular to limb axis (Fig. 1AB).

Eleutherodactylus chiastonotus is readily distinguished from all other species of the *fitzingeri* group by its color pattern and markedly acuminate snout (the longest of any species in the species group).

It is seemingly the northeastern South American counterpart of the Amazonian *E. conspicillatus*, the Venezuelan *E. terraebolivaris*, and the Chocoan *E. achatinus*, but differs from all in color pattern, snout shape, and in lacking any basal webbing of the toes.

Description.—Head as broad as or slightly broader than body, head longer than wide (head width 77–83% head length); head width 31.6–36.4 (\bar{x} = 33.6, n = 20) % SVL in males, 32.6–36.1 (\bar{x} = 34.2, n = 14) in females; snout markedly acuminate in dorsal view, pointed and overhanging lower jaw in lateral profile (Fig. 3); snout long, E–N 91.8–123.6 (\bar{x} = 110.7, n = 19) % eye length in males, 108.5–135.2 (\bar{x} = 121.6, n = 14) in females; canthus rostralis sharp, straight or weakly convex; loreal region flat or weakly concave, sloping abruptly to lips; lips not flared; nostrils weakly protuberant, directed laterally; tip of snout rounded, no proboscis; inter-orbital space slightly wider than upper eyelid width, flat; upper eyelid width 67.5–117.6 (\bar{x} = 90.0, n = 20) % IOD in males, 55.1–121.0 (\bar{x} = 74.0, n = 14) in females; no frontoparietal fontanelle; temporal region vertical; tympanum round in males, its length 43.8–57.1 (\bar{x} = 51.5, n = 20) % length; tympanum higher than long in females, its length 49.0–62.3 (\bar{x} = 54.7, n = 14) % eye length; supratympanic fold prominent, thin, not obscuring upper edge of tympanum; choanae partially concealed by palatal shelf of maxillary arch when roof of mouth is viewed from directly above; choanae moderate-sized, each about as large as an odontophore; prevomerine odontophores elevated, triangular in outline (slanted or oblique in small specimens), posterior and median to choanae, separated by a distance equal to width



Fig. 1. (A-B) *Eleutherodactylus chiastonotus*, holotype, RMNH 17614, 38.4 mm SVL; (C-D) *Eleutherodactylus zeuctotylus*, holotype, RMNH 17701, 25.4 mm SVL.

of a process, bearing 3-5 teeth arranged in a transverse row across posterior edge of odontophore (rarely as an oblique patch); tongue longer than wide, notched posteriorly, posterior $\frac{1}{3}$ to $\frac{2}{5}$ not adherent to floor of mouth; male with large subgular vocal sac and slits.

Skin of dorsum finely shagreened, becoming granular on flanks; skin of upper eyelids no more granular than that of top of head; dorsolateral fold poorly defined, granular; no supra-anal warts; skin of throat smooth,



Fig. 2. Hand and foot of *Eleutherodactylus chiastonotus* holotype, RMNH 17614; line equals 5 mm.

in males with two oblique folds near mandible; skin of venter smooth (granulations of lower flanks enroach on posterior parts of venter); discoidal folds prominent; skin on posteromedial surfaces of thigh (below vent) aerolate; forearm lacking ulnar folds or tubercles; palmar tubercle bifid

(Fig. 2), larger than oval thenar tubercle; supernumerary palmar tubercles prominent, smaller than subarticular tubercles; subarticular tubercles large, round, non-conical; fingers lacking lateral fringes; first finger longer than second; all fingers bearing pads, pads on inner fingers round, about $1\frac{1}{2}$ times width of digit below pad; pads on outer fingers about $2\frac{1}{2}$ times width of digit below pad; all pads bearing broad discs; fold of skin above pad not indented.

No enlarged tubercles on heel; outer edge of tarsus lacking tubercles, inner edge bearing an elongate tubercle just proximal to inner metatarsal tubercle; no tarsal folds; 2 metatarsal tubercles, outer round, flat, $\frac{1}{4}$ to $\frac{1}{6}$ size of elongate (length 2 to 3 times width), non-compressed inner metatarsal tubercle; plantar surface lacking supernumerary tubercles or with small tubercles at the bases of toes II-V; subarticular tubercles like those of fingers except more conical; toes lack webbing and lateral fringes; all toes bearing pads and discs, pads round, that on inner toe smaller than those on other toes; toe pads distinctly larger than pads of inner fingers, smaller than to equal in size to those of outer 2 fingers; heel of adpressed hindlimb reaches to nostril; when legs are flexed at right angles to sagittal plane, heels distinctly overlap; shank 51.4-64.6 ($\bar{x} = 57.1$, $n = 34$) percent SVL.

In preservative, *E. chiastonotus* is pale rusty-tan above with pale brown markings. The flanks are more pale than the dorsum. The canthal and supratympanic stripes are dark brown and fade ventrally. Labial bars are only faintly visible. The limb bars are pale brown edged with cream; the bars are about as wide as the tan interspaces and are transversely oriented. The posterior surfaces of the thighs and anal patch are medium brown. The venter is dull cream (under magnification is peppered with black); throat and upper chest bearing pale spots.

Color in life.—Back and legs ochre-yellow, beige or yellow-orange, with a pattern of light-brown or beige-brown bands of varying width, forming a distinct X-shaped mark on the back, chevrons or oblique bands on the back and flanks, transverse bands on the legs, an interorbital bar, 2 spots on the snout and 2 bands radiating from the eye to the upper lip. The elements of the darker pattern are bordered by a narrow black or dark-brown and a narrow pale yellow line. Some specimens (from L oe Creek and Sa ul) have a cream-colored vertebral stripe from the tip of the snout to the vent. Canthal and supratympanic stripe dark brown. Dorsally this stripe is bordered by a narrow pale-brown to pale-yellow line, passing over the canthus rostralis and the outer edge of the upper eyelid; ventrally there is no sharp border anterior to the tympanum; in some specimens nearly the whole loreal region and the upper lip are dark-brown. Tympanum chestnut-brown to light-brown. A dark-brown spot at the base of the forelimbs is sometimes present. Throat white, dirty-white or yellow with

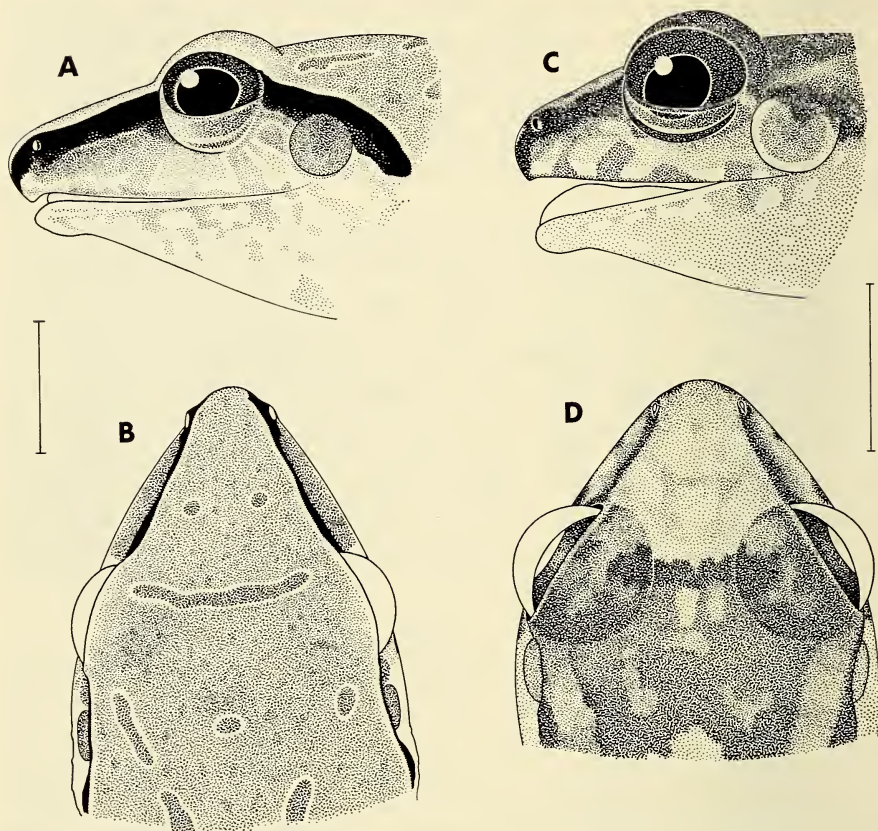


Fig. 3. (A-B) *Eleutherodactylus chiastonotus*, RMNH 17614; line equals 5 mm; (C-D) *Eleutherodactylus zeuctotylus*, RMNH 17701; line equals 5 mm.

gray spots, belly yellowish-white. Groin, ventral, anterior and posterior surfaces of the thighs, posterior and ventral surfaces of the lower leg, and palms bright orange. The soles may be orange, gray or dark-brown. Ventral surface of forelimbs transparent flesh-colored. Iris divided in 3 parts: an upper golden part, a silvery gray, gray-brown, or gray-green lower part, both parts separated by a horizontal reddish-brown bar. Around the pupil, a narrow band, anteriorly reddish brown, posteriorly yellow.

Measurements of holotype (mm).—SVL 38.4; shank 20.8–21.5; head length 15.3; head width 12.3; upper eyelid width 3.0–3.1; IOD 4.0; eye length 4.6–4.7; tympanum length 2.4–2.6; E–N 5.7–5.8; eye to tip of snout 8.0–8.3.

Etymology.—Greek, in reference to the X-shaped mark (chi-like) on the dorsum.

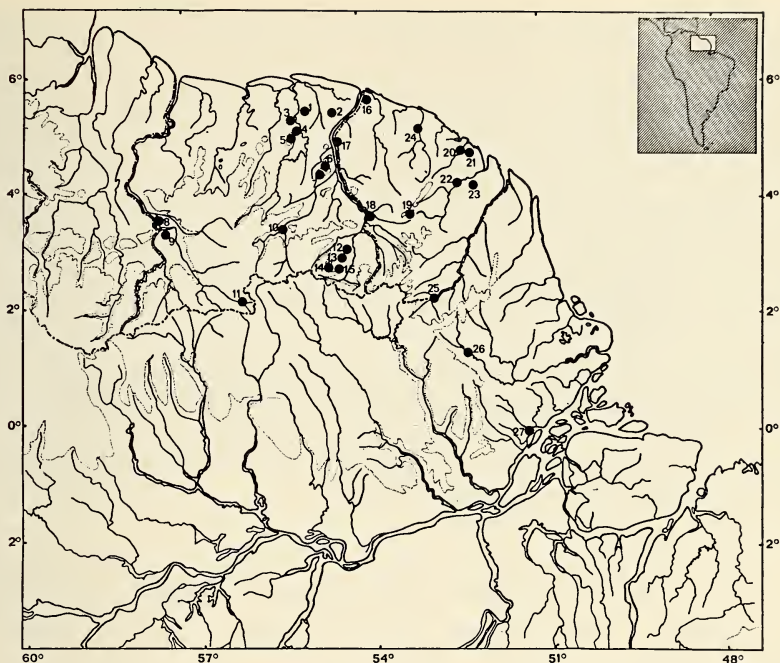


Fig. 4. Distribution of *Eleutherodactylus chiastonotus*; see list of paratypes for names of localities. Dotted lines denote 200 m contour.

Distribution.—Low elevation (below 700 m) forests in northeastern Brazil, French Guiana, and Surinam (Fig. 4).

Natural history.—In Surinam, *E. chiastonotus* is much less abundant than is *E. zeuctotylus*; in Brazil and French Guiana, *E. chiastonotus* may be the more abundant, based on numbers of specimens available. Hoogmoed collected *E. chiastonotus* between 0815 and 2230 hrs. Most specimens were collected by day in leaf litter on the forest floor; however, the frog is a nocturnal species. Daytime collections resulted from chasing the frogs from their hiding places. Only occasional specimens were found in the daytime (early morning) sitting on leaves of low vegetation. At night, most were found on leaves and branches of herbs, shrubs, and felled trees, 3–100 cm above the ground; others were discovered on the forest floor.

Eleutherodactylus chiastonotus was never found outside of the high forest. In Surinam, the frog occurs south of the coastal belt of savannas, but in some places (Patamacca and S of Blakawatra) along the southern edge of the savannas, it invades the savannas along creeks supporting gallery forests. In the Sipaliwini area, *E. chiastonotus* was found in the rain-

forest to the west of the savanna but not in the forest islands surrounded by savanna.

Males were observed calling as early as 1745 hrs, from elevated stations (0.5–1.0 m above ground) on thin branches of shrubs or young trees but not on tree trunks or logs. Calling males were heard and/or recorded in the months of November, January, and May. In Surinam, females containing large oviducal eggs were found in October, January, and March; females taken in July and August have only small ovarian eggs. On 28 May 1968 at 0900 hrs, several apparently recently hatched juveniles were found on leaves of *Selaginella* a few centimeters above the ground in high forest. Slightly larger juveniles were found on 25 June and 2 August. Thus reproduction is apparently seasonal in *E. chiastonotus*, distributed through the short rainy season, the short dry season, and the long rainy season. The only adult female from Brazil (WCAB 35968) is gravid and was collected in December. Males collected in January had distended vocal sacs whereas those taken in October did not.

The call of *E. chiastonotus* is a single note (Fig. 5).

Eleutherodactylus zeuctotylus, new species

Hylodes gollmeri: Van Lidth de Jeude, 1904:93.

Holotype.—RMNH 17701, an adult male collected on west slope, Vier Gebroeders Mountain, Sipaliwini, Nickerie District, Suriname, on 7 February 1970 by M. S. Hoogmoed (locality 34, Fig. 7).

Paratypes.—(242). BRAZIL, *Estado Amapá*: (44) Mazagão, WCAB 19183; (43) Serra do Navio, KU 140881, WCAB 27238. *Estado Amazonas*: (not on map) Serra da Neblina (nr Colombia-Venezuela border), WCAB 34157. *Estado Pará*: (not on map) Rio Mapuerá at equator, AMNH 46200; (42) Tiriós (near Surinam border), WCAB 12740.

FRENCH GUIANA: no further data, LG 671, 824, LDG 29; (38) Cabassou, near Cayenne, LG 184; near Cayenne, LG 1014–15; (37) Crique Grégoire, LG 761, 804; (39) Montagne de Kaw, LG 1492–93; (40) Saül, LG 38, 1058–61, 1093, 1406; (41) Trois Sauts, Oyapock river, LG 1127, 1282–84, 1292.

GUYANA, *Rupunini District*: (36) N of Acarai Mountains, W of New River, KU 69663; (not on map) Shudikar-wau, AMNH 43680.

SURINAM, *Brokopondo District*: (11) Brownsberg, 450–500 m, AMNH 87740, RMNH 17661, 17668(2), 17673, 17682(6); Brownsberg Natuurpark, MCZ 89209–10, 89212–13; foot of Brownsberg, RMNH 17665(5); Brownsberg, near Suralco house, 500 m, RMNH 17671; Brownsberg, 2 km E Suralco house, 500 m, RMNH 17666; railway km 121, foot of Brownsberg, upper Mahami creek, RMNH 17697–98; (28) upper Gran Rio, RMNH 17689; (10) Guyana Goud Placer, RMNH 17691(7); (2) 4 km SE Kraka,

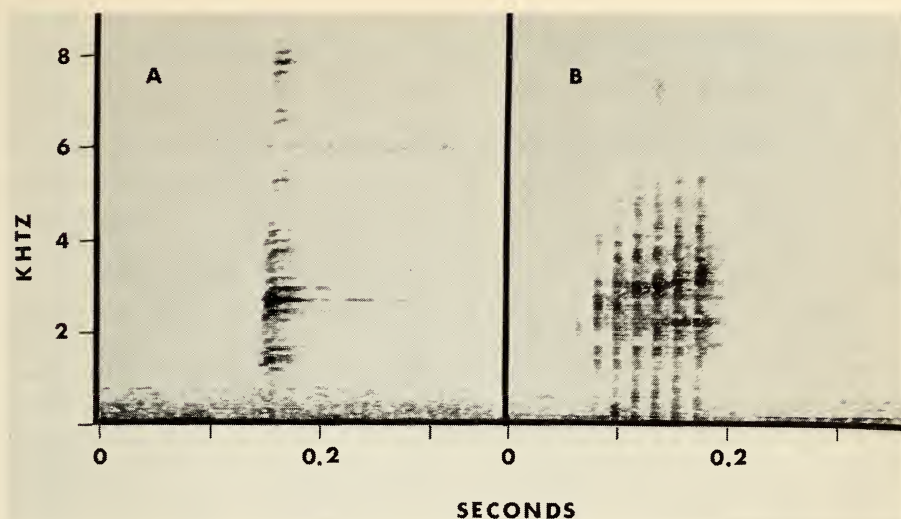


Fig. 5. (A) Audiospectrogram of call of *Eleutherodactylus chiastonotus*, holotype (RMNH 17614); tape 1968-IV A (177-202), recorded at 19 cm/sec; air temperature about 21 C. (B) Call of *Eleutherodactylus zeuctotylus*, holotype (RMNH 17701); tape 1970 A (120-160), recorded at 19 cm/sec; air temperature about 22 C.

RMNH 17653; near Saramaca River, km 91.5, BM 1946.4.1.22. *Commewijne District*: (3) camp 8, Mapane area, RMNH 17688. *Marowijne District*: (14) Lely mountains, Suralco camp IV, 560-690 m, RMNH 17644(3), 17646(12), 17656, 17708, 17758(4), 17759-60, 17761-64(10), 17765, 17770; (13) Lely mountains, headwaters of Djoeka creek, Suralco camp V, 610-620 m, AMNH 90826, RMNH 17645(2), 17648(2); (35) Loe Creek, camp Hofwijks VII, 54 km S Oelemari airstrip, 120 m, AMNH 90827, RMNH 17647(2), 17650, 17654-55, 17659(2); (12) Nassau mountains, km 1.1, RMNH 17699; (30) Paloemeu airstrip, RMNH 17687, USNM 159027. *Nickerie District*: (5) Avanavero road, km 251, Paris Jacob Creek, 60 m, RMNH 17649(3), 17768(4); (7) Avanavero road, km 219, Van Ams Creek, 80 m, RMNH 17651, 17657; (4) Kabalebo River, Avanavero cataracts, 50 m, RMNH 17773; (45) Linker Kabalebo River, river camp, RMNH 17776; (15) Rechter Kabalebo River, 2nd fall, 120 m, RMNH 17757, Brokobotoval, RMNH 17751, Doublestepsval, 120 m, RMNH 17772, Grote Belgiëval, 130 m, RMNH 17658(4); (16) Rechter Kabalebo River, K. vallen, 180 m, RMNH 17771; 10 km S K. vallen, 180 m, RMNH 17756; (29) airstrip, Kayser mountains, FMNH 128829, 128843; SE of airstrip, Kayser Mts. RMNH 17683; (23) King Frederick Willem IV Falls, BM 1936.9.3.13-14; Lucie River, RMNH 17690(2); (25) Lucie River, 10 km NE Coeroeni airstrip, 180 m, RMNH 17766; 10-20 km N Lucie River, 200-250 m, RMNH 17767;

(26) Eva Creek, 20 km N Lucie River, 200 m, RMNH 17754(2), 17755; (27) Vreedzaam Creek, 10 km N Lucie River, 200 m, RMNH 17753(2); (1) camp on Maratakka River, RMNH 17704; (24) encampment Tigri, New River (= upper Corantyne River), RMNH 17672; (31) upper New River (= upper Kutari Creek), BM 1936.4.2.9; (32) "New River, 230 m," BM 1939.1.1.22-24; (6) Blanche Marie Cataracts, Nickerie River, 80 m, RMNH 17652(3), 17703; (7) Reynold's camp (Grassalco), Mozes Creek, 90 m, RMNH 17660, 17769; 3 km S Reynold's camp, Mozes Creek, 250 m, RMNH 17752; (33) Sipaliwini, E of airstrip, RMNH 17685, 17700, 4 km E airstrip, RMNH 17664(2), 17670, 17674, 17679-80, 17684, 17686, 17702(6); (34) Sipaliwini, Vier Gebroeders Mountain, RMNH 15168(2), 15180, 15196, 17675-77, 17681; Sipaliwini, 2 km N Vier Gebroeders Mountain, RMNH 17678(2). *Saramacca District*: Coppename River, RMNH 4900; (8) Coppename River, camp 1, BM 1946.4.1.3-21; (9) Coppename River, Raleigh cataracts, 50 m, AMNH 87741-43, RMNH 17662, 17663(13) 17669; (19) Linker Coppename River, ZMA 6293; Rechter Coppename River, RMNH 17695; (17) Hebiweri, RMNH 17692(2); (22) Tafelberg airstrip, 250 m, RMNH 17643(7); (21) trail from Toekoemoetoe Creek to Tafelberg, km 3, RMNH 17696; (20) Wilhelmina Mountains, transect I, RMNH 17693(4); (18) Wilhelmina Mountains, transect II, RMNH 17694.

Diagnosis.—A moderate-sized *Eleutherodactylus* [$\delta \delta$ 20.4-29.6 mm SVL ($\bar{x} = 25.5$, $n = 20$), ♀ 30.5-43.3 ($\bar{x} = 37.0$, $n = 32$)] of the *fitzingeri* group; toes lacking basal webbing; digits bearing narrow lateral keels; digits bearing pads and discs, pads of inner fingers 1.2-2.0 ($\bar{x} = 1.5$) times digit width below pad, those of outer fingers 2.2-2.9 ($\bar{x} = 2.5$) times digit width; palmar tubercle round (not divided); no tarsal fold; no tubercles on heel; inner metatarsal tubercle much larger than outer; skin of dorsum granular; dorsolateral ridges present; tympanum prominent, round, its length about half that of eye; males with vocal sac and slits; legs of moderate length, shank 48.0-60.8% SVL; venter dusky, not patterned; dorsum mottled brown on gray ground color; posterior surfaces of thighs dark brown; limb bars transverse, slightly to distinctly wider than interspaces.

No other species of the *fitzingeri* group has an entire (undivided) palmar tubercle. *Eleutherodactylus zeuctotylus* is also distinctive in having a long thumb; the long thumb and large digital pads of *E. zeuctotylus* are reminiscent of *E. heterodactylum* (Miranda-Ribeiro). The two are readily distinguished because *E. heterodactylum* has much narrower limb bars and smaller tympana. In habitus, coloration of the posterior thigh, and some proportions, *E. zeuctotylus* resembles *E. fenestratus* (Steindachner), *E. lathanites* Lynch, and *E. vilarsi* (Melin).

Description.—Head as broad as body, slightly longer than wide; head width 36.6-39.9 ($\bar{x} = 38.2$, $n = 20$) % SVL in males, 34.0-42.0 ($\bar{x} = 36.6$, $n = 32$) in females; snout subacuminate in dorsal view, rounded in lateral

profile, not extending much beyond lower jaw (Fig. 3); snout moderate in length, E-N 75.0–100.0 (\bar{x} = 86.2, n = 20) % eye length in males, 70.1–115.6 (\bar{x} = 97.1, n = 31) in females; nostrils weakly protuberant, directed dorsolaterally; canthus rostralis sharp, convex; loreal region weakly concave, sloping abruptly to non-flared lips; interorbital space flat, no frontoparietal fontanelle; upper eyelid width 74.2–126.1 (\bar{x} = 98.8, n = 19) % IOD in males, 77.1–116.7 (\bar{x} = 93.8, n = 31) in females; tympanum round in males, its length 51.1–68.8 (\bar{x} = 59.7, n = 20) % eye length; tympanum round to higher than long in females, its length 38.3–64.4 (\bar{x} = 55.5, n = 31) % eye length; supratympanic fold not obscuring upper edge of tympanum; tympanum separated from eye by less than half tympanum length; choanae lying within palatal shelf of maxillary arch; choanae moderate-sized, each about the size of an odontophore; prevomerine odontophores triangular in outline, posterior and median to choanae, separated by $1\frac{1}{2}$ choanal widths, bearing a row of teeth across posterior edge; tongue longer than wide, weakly notched posteriorly, posterior half not adherent to floor of mouth; males with subgular vocal sac and vocal slits.

Skin of dorsum finely granular to finely areolate, that of flanks more coarsely areolate, no enlarged warts; dorsolateral folds glandular; no enlarged supra-anal warts; skin of throat smooth, in males with two oblique folds near mandible; skin of venter smooth; discoidal folds prominent; skin on posteroventral surfaces of thighs (below vent) areolate; forearm lacking ulnar folds of tubercles; palmar tubercle not bifid (Fig. 6), larger than oval thenar tubercle; supernumerary palmar tubercles round, prominent; subarticular tubercles round, weakly conical; fingers bearing indistinct lateral keels; first finger distinctly longer than second; all fingers bearing pads and discs, pads slightly broader than long, those on inner fingers 1.2–2.0 times digit width below pad, that on finger II smallest, on outer two fingers 2.2–2.9; pads of outer fingers $\frac{3}{5}$ to $\frac{3}{4}$ tympanum length.

Heel lacking enlarged tubercles; outer edge of tarsus smooth, inner edge bearing tubercle just proximal to inner metatarsal tubercle; 2 metatarsal tubercles, outer round, conical, $\frac{1}{3}$ size of elongate (length twice width), non-compressed inner; plantar supernumerary tubercles restricted to base of toes II–IV; subarticular tubercles round, conical; toes lacking webbing; toes bearing indistinct, lateral keels; all toes bearing discs and pads, wider than long; toe pads slightly smaller than those of outer fingers; pad of toe IV largest; heel of adpressed hindlimb reaches between eye and nostril; when legs are flexed at right angles to sagittal plane, heels distinctly overlap; shank 49.5–60.8 (\bar{x} = 55.2, n = 20) % SVL in males, 48.0–59.8 (\bar{x} = 54.0, n = 32) in females.

In preservative, *E. zeuctotylus* is gray to gray-brown above with brown spotting or marbling; the body pattern varies from distinct marbling to little, if any, pattern; pattern usually diminishes on flanks; limb bars



Fig. 6. Hand and foot of *Eleutherodactylus zeuctotylus*, holotype, RMNH 17701; line equals 5 mm.

slightly wider than interspaces and transverse, but in some bars are broken up and shank is marbled; canthal and supratympanic stripes and labial bars dark brown; groin, posterior surfaces of thighs, ventral surfaces of shank dark brown; venter gray to dark brown with white flecks on throat; snout paler than dorsum, bearing pair of brown spots.

In life, *E. zeuctotylus* is colored as follows: back orange-brown, red-brown, brown, gray brown, or greenish-gray with an indistinct darker pattern of lines and spots; flanks sometimes yellowish-green; snout, in front of eyes, paler than dorsum; upper arm of juveniles orange-brown to yellow; venter dark gray to black, throat with white spots; upper lip spotted black and white; canthal and supratympanic stripe black; tympanum chestnut-



Fig. 7. Distribution of *Eleutherodactylus zeuctotylus* in Guiana region; see list of paratypes for names of localities. Dotted lines denote 200 m contour.

brown; iris gold, divided horizontally by reddish-brown band (lower part of iris sometimes darker than upper part); groin, back of thighs, and underside of shank minium.

Measurement of holotype (mm).—SVL 25.4; shank 14.1–14.3; head length 10.8; head width 10.0; upper eyelid width 2.4–2.6; IOD 2.6; tympanum length 2.6; eye length 4.0–4.3; E–N 3.4; eye to tip of snout 5.0.

Etymology.—Greek, in reference to the fused (undivided) palmar tubercle.

Distribution.—In Surinam, *E. zeuctotylus* inhabits low elevation (0–690 m) forests. Altitudinal data are lacking for non-Surinam localities, but the altitudinal range is probably the same in Guyana, French Guiana, and northeastern Brazil (Fig. 7). In addition to the Guianas, *E. zeuctotylus* is known from the Serra de Neblina, in Amazonas, Brazil (near the common border with Colombia and Venezuela) (WCAB collection), and from Cachoeira Santo Antonio, Estado Rondonia, Brazil (just upstream from Porto Velho) (specimens in USNM and Museu de Zoologia, Universidade de São Paulo); these two localities are not mapped in Fig. 7.

Natural history.—Although this species has been collected nearly all

day and night, except during the period 0030–0645 hr, it is a nocturnal frog. Practically all specimens collected during the daytime were found in leaf-litter on the forest-floor, in heaps of fallen leaves at the base of prickly palms in leaves accumulated between buttresses or in entrances of burrows, under logs, loose pieces of bark on the ground, or under rocks. Occasionally individuals were found sitting on tree trunks, roots, or rocks in the early morning, indicating some daytime activity. Others were likely hiding among leaves or under the objects mentioned, and when startled started jumping around. An especially favored hiding place seems to be among leaves accumulated at the entrance of burrows; several times up to four individuals were observed to be hiding there. At night the frogs were found at quite different places, on leaves of herbs, shrubs and trees 10–300 cm above the ground, and on logs and rocks in or along creeks. The species never was found outside the forest. In most places this is high forest, but in several places (e.g., SE of Kraka), it is low forest on sandy soil or cloud-forest (e.g., in some places on Lely Mountains). In Surinam and in French Guiana the species is generally found south of the coastal savanna-belt, but there is some invasion along the southern edge where sufficient forest is present. In the Sipaliwini savanna in southern Surinam, the species occurs in forest-islands completely surrounded by savanna. The species seems to have a preference for clearings in the forest; at least males were heard calling around the edges of camp clearings throughout the country. Even recent clearings had higher concentration of calling males around them than did the surrounding forest. Males were observed calling from 1815 hr on, in the months November, December, January, February and May. They call preferably from logs or from trunks of small trees. When calling, the males may be positioned on vertical surfaces with the head pointing downward, or they may call from horizontal surfaces. Females containing large oviducal eggs were found in November, December, January, February, March and June. Females with small ovarian eggs were found in August and September, and recently hatched juveniles in May. This means that the species is reproductively active during the short rainy season, the short dry season, and the long rainy season. From the beginning of the long dry season on, females start to form ovarian eggs which apparently require about 2–3 months to mature. The mating call of *E. zeuctotylus* is a short trill (Fig. 5).

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